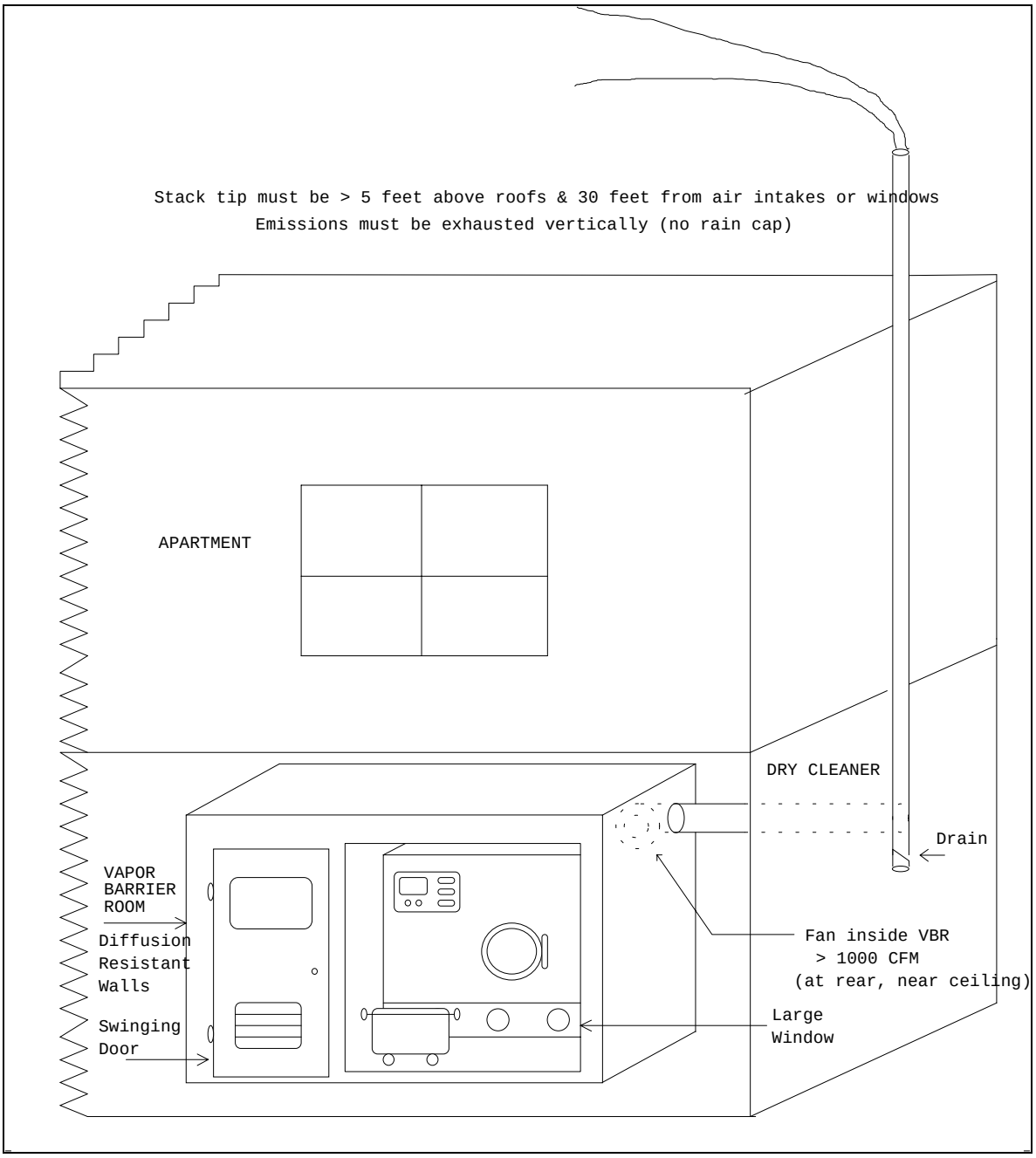
DRY CLEANER VENTILATION GUIDELINES

Vapor Barrier Room in a Co-residential Dry Cleaning Facility



Vapor barrier rooms are required by Regulation 11, Rule 16 for co-residential perchloroethylene dry cleaning facilities to minimize the exposure to perchloroethylene and the associated risk to affected residents. VBRs may be necessary and are recommended for non-residential facilities that cause high exposures of Perc to adjacent residential or occupational receptors (particularly in co-located situations such as multistory commercial buildings and shopping malls that do not have good separation between units). A vapor barrier room restricts diffusion and transport of solvent vapors that escape from a dry cleaning machine and a ventilation fan collects virtually all of these vapors and exhausts them through a stack above the building. The cost of a vapor barrier room is typically $3,000-$5,000 but could be as high as $10,000 depending on the size, location, and difficulty of construction.

DRY CLEANER VENTILATION GUIDELINES

Vapor Barrier Room in a Co-residential Dry Cleaning Facility

Construction and Operation Guidelines:

Vapor barrier rooms shall be constructed of material resistant to diffusion of solvent vapors such as metal foil faced insulation sheets or heavy plastic sheeting sandwiched between dry wall (gypsum) sheets. Seams should be offset for multiple layers of material. Seams and gaps should be sealed with aluminized tape (not standard duct tape) at each layer -- it is also recommended to caulk with silicon sealant for large gaps prior to taping**.** *[NOTE: Please contact your city or county building department and obtain a building permit for the construction of the vapor barrier room and electrical work. Some vapor barrier materials may need to be covered with gypsum board to meet fire code and building code requirements. In addition, building codes have minimum dimensions for doors and access aisles -- for example, allow at least 32 inches clear for doors and at least 3 feet clear between new walls and the front or back of a machine. Exceptions may be approved by the building department.]*

The door(s) to the VBR should be normally closed (self-closing devices are recommended); it may be a "swinging" design that opens both ways or a sliding door. Windows may be installed in doors or walls to allow light, for safety reasons, or for make-up air. Plexiglas or tempered glass is recommended.

Fresh make-up air may be supplied from the shop through gaps around the entry door(s) or if necessary with sliding windows or adjustable louvers. It is suggested that make-up air be introduced at the front of the machine and at the same height as the loading door. The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the VBR. Warm air rises transporting solvent vapors towards the ceiling -- placing the fan near the ceiling will remove the warm air and vapors effectively. The fan should produce an adequate air flow (minimum 1000 CFM) to maintain a capture velocity greater than 100 feet per minute at any intentional gap or opening or about 50 FPM at entry door when (temporarily) open.

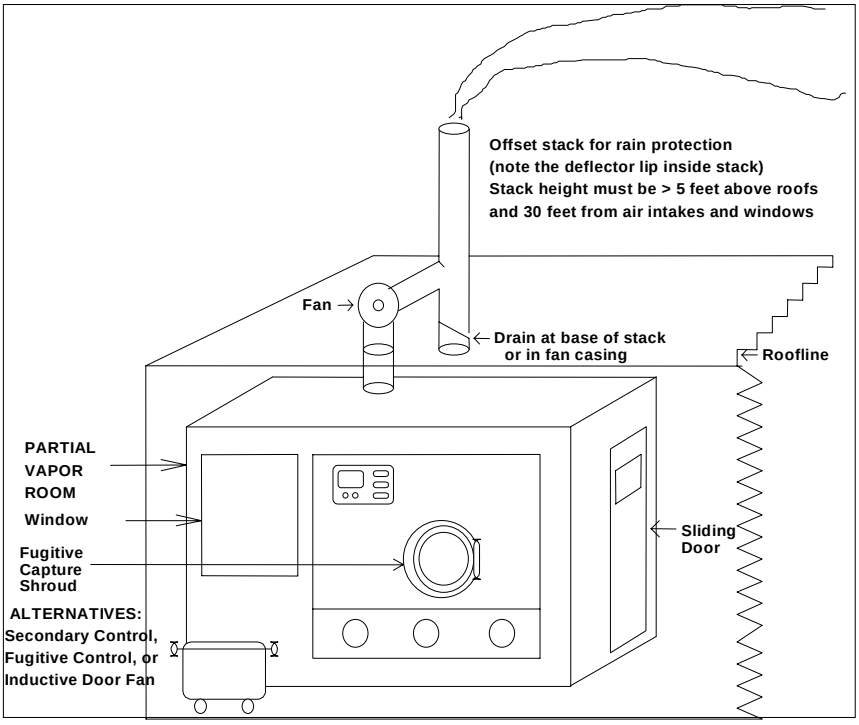
The exhaust fan may be installed inside the VBR (near ceiling at back of machine or VBR) or outside the facility on a wall or on the roof; should be of a high pressure (1-3 " H_2O) design with a minimum capacity of 1000 CFM; and should be run continuously (24 hours a day, 365 days a year) in a co-residential facility and whenever the dry cleaning machine is operating or being maintained in a non-residential facility. The stack should extend at least 5 feet (up to 15 feet) above the roofline or any adjacent roof and at least 30 feet from any air intake or window. Emissions must be exhausted vertically (no rain caps). Proper stack design (see Figure 6-24, Stackhead Designs, ACGIH) eliminates rain intrusion with offset legs, drains, and internal deflectors. External fans may also have drain holes. The diameter of the stack should generally be 8 to 14 inches with an air flowrate of 1000 to 2500 CFM to provide good dispersion. The air change rate shall be greater than once every five minutes for a co-residential facility and once every ten minutes for a non-residential facility.

Spotting using Perc containing solvents should be done within the VBR for co-residential facilities. Solvent and waste drums may be stored in VBR.

DRY CLEANER VENTILATION GUIDELINES

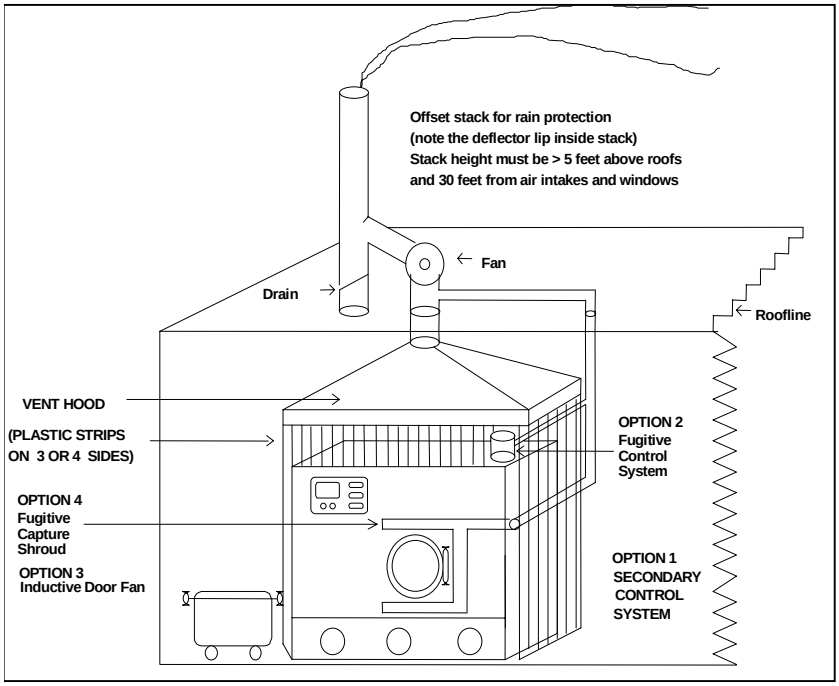
Partial Vapor Room

Partial Vapor Rooms (PVRs) should be constructed of material resistant to diffusion of solvent vapors such as metal foil faced insulation sheeting or heavy (minimum 22 mil) plastic sheeting sandwiched between dry wall sheets (offset seams). Seams and gaps should be sealed with aluminized tape (not standard duct tape). Plexiglas may be used as windows to allow light and for safety. The PVR should surround the back of the machine with the face of the machine and loading door accessible to the operator from the outside of the room. Maintenance entry door(s) shall be normally closed (self-closing or alarmed).



Local Ventilation System

Local ventilation systems (LVSs, hoods and shrouds to capture fugitive emissions at point of release) are necessary for some non-residential facilities to minimize exposure of perc to nearby residents or commercial/ industrial receptors. Fume hoods should have plastic curtains on the sides (or a combination of walls and curtains) to minimize cross-flow draft problems and provide better capture velocity.



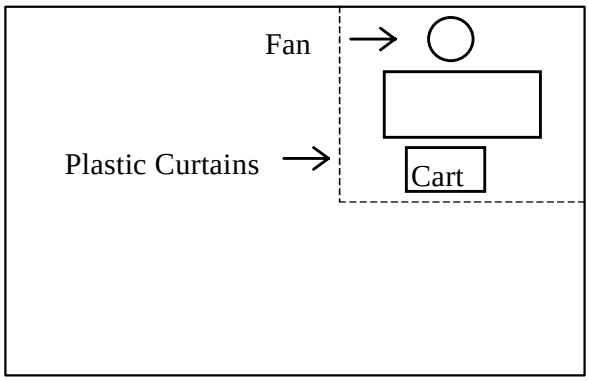
DRY CLEANER VENTILATION GUIDELINES

Partial Vapor Rooms and Local Ventilation Systems:

If a closed-loop dry cleaning machine is not totally enclosed (by walls for PVR or plastic curtains for LVS), an inductive door fan, a fugitive control system or a fugitive capture shroud is required to assure that most of the emissions from the loading door are captured by the ventilation fan. There should be adequate airflow (minimum 1000 CFM but likely much higher: 2,500-10,000 CFM) to maintain a capture velocity greater than 100 feet per minute at any fugitive capture structure (such as a shroud at the loading door and the fume hood). An air change rate of at least once every 10 minutes is generally adequate in a stand alone building, but greater air change is recommended for mixed-use buildings. The exhaust fan(s) may be installed inside the PVR/LVS or outside the facility on a wall or on the roof; should be a high pressure (1-3 " H_2O) design with a minimum capacity of 1000 CFM and should be run whenever the dry cleaning machine is operating or being maintained. The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the PVR or LVS. The stack should extend at least 5 feet above the buildings roofline or any adjacent roof and at least 30 feet from any air intake or window. Emissions must be exhausted vertically (no rain caps). Proper stack design (see Figure 6-24, Stackhead Designs, ACGIH) eliminates rain intrusion with offset legs, drains, and internal ridges. The diameter of the stack is related to the total air flowrate and desired exhaust velocity for good dispersion: generally a diameter of 8 to 14 inches and a flowrate of 1000 to 2500 CFM will provide adequate exhaust velocity (10-20 meters per second).

Partial Vapor Rooms or Vapor Barrier Rooms are more effective than local or general ventilation for capturing emissions and are highly recommended for co-located situations such as multistory commercial buildings and shopping malls that do not have good separation between units. A fugitive control system or a secondary control system is also recommended to reduce emissions and associated risk. A fugitive control system has an inductive door fan that draws air from drum and through the loading door prior to and/or when the loading door is opened; exhaust is normally abated with a carbon adsorption system. A secondary control system has a small carbon adsorber that collects residual solvent vapors from recirculating air at the end of the drying cycle. Fugitive and secondary control systems must be regularly regenerated to be effective.

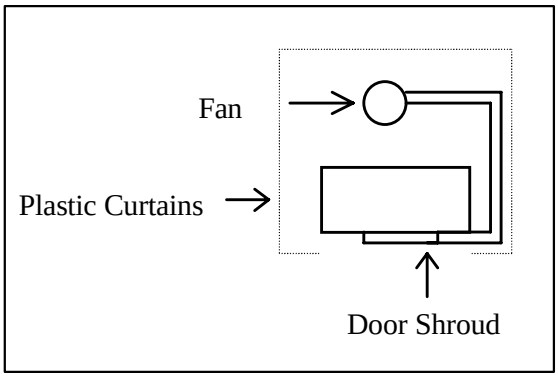
LVS Enclosing a Dry Cleaning Machine



TOPVIEW

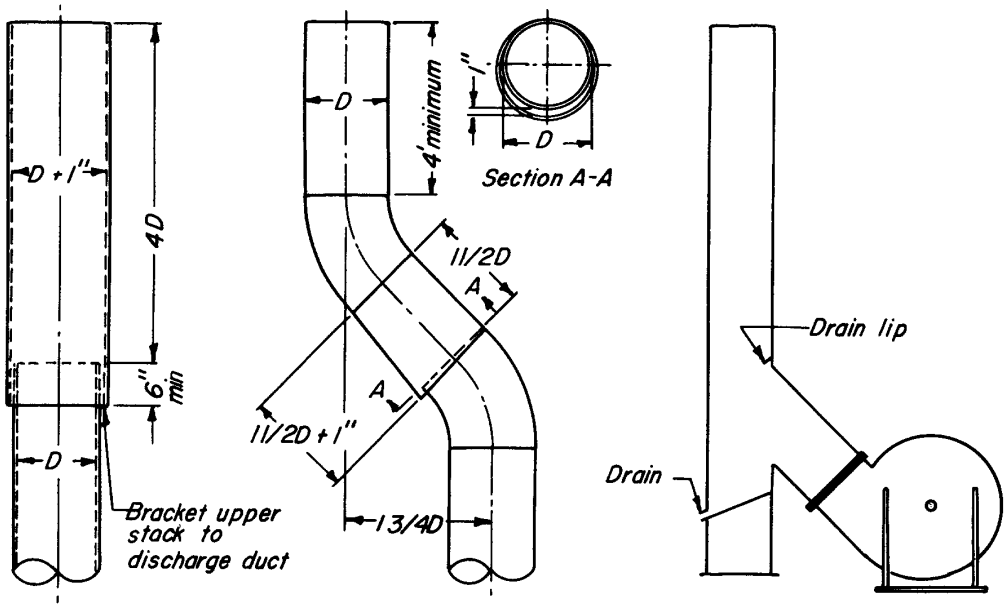
Combinations of solid walls and plastic curtains may create an effective capture area. Walls or plastic curtains should extend at least 3 feet in front and back of the machine for operation and maintenance. The exhaust fan should be mounted above or behind the machine near the ceiling. Exhaust point should be at least 5 feet above the building or adjacent building and 30 feet from any window or air intake.

LVS with a Loading Door Shroud



TOPVIEW

A LVS (or partial vapor room) that does not enclose the loading door of a standard closed-loop machine must include 1) a capture shroud at the loading door; 2) an inductive door fan; or 3) a fugitive control system to minimize fugitive emissions. Effective capture systems should have capture velocity greater than 100 feet per minute.



VERTICAL DISCHARGE [87][116] — No loss

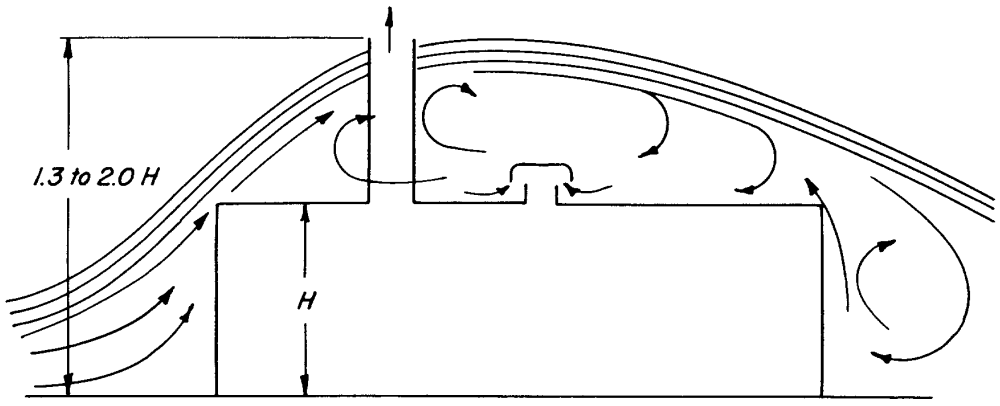
OFFSET ELBOWS [106] — Calculate losses due to elbows

OFFSET STACK [106]

1. Rain protection characteristics of these caps are superior to a deflecting cap located 0.75D from top of stack.

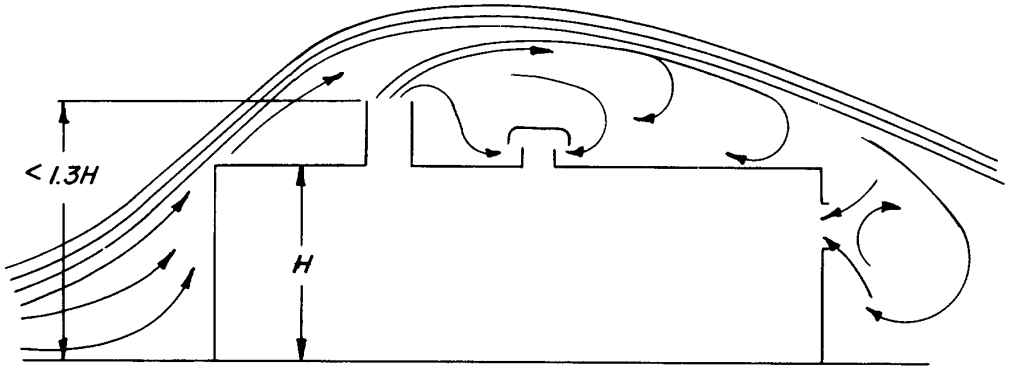
2. The length of upper stack is related to rain protection. Excessive additional distance may cause "Blowout" of effluent at the gap between upper and lower sections. [86]

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	
STACKHEAD DESIGNS	
DATE 1-76	Fig. 6-24



GOOD

High discharge stack relative to building height, air inlet on roof.



POOR

Low discharge stack relative to building height, air inlet on roof and wall.

These guidelines apply only to the simple case of a low building without surrounding obstructions on reasonably level terrain.

See Fig. 6-24

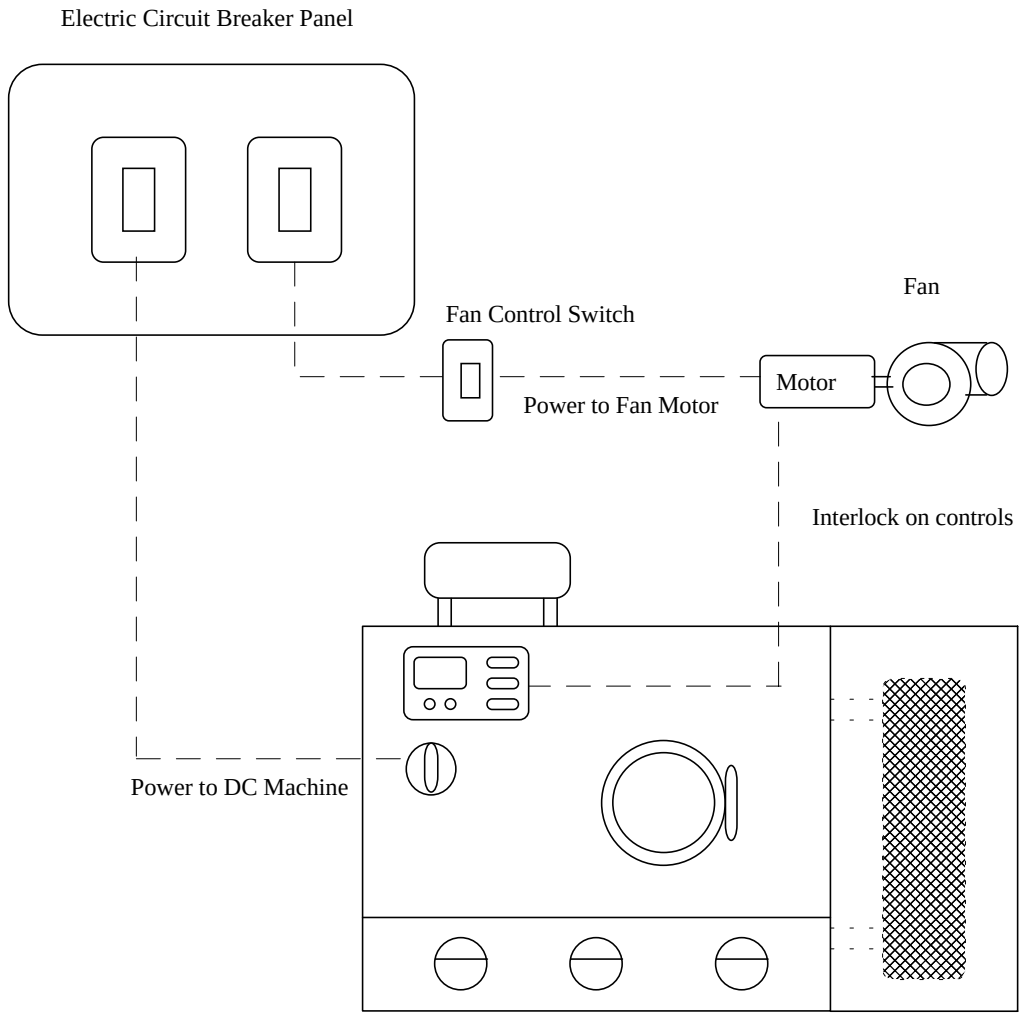
AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	
BUILDING AIR INLETS AND OUTLETS	
DATE 1-76	Fig. 6-23

(Ref 87)

DRY CLEANER VENTILATION GUIDELINES

Guidance for Wiring Ventilation Fans and Dry Cleaning Machines

Parallel Circuit Breakers & Control Interlock

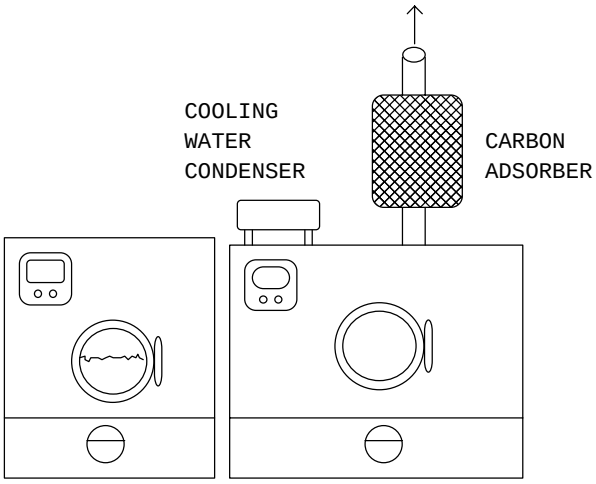


Regulation 11, Rule 16, Section 307 requires ventilation systems that operate whenever the dry cleaning machine is operating for non-residential facilities and continuously for co-residential facilities. Therefore, it is necessary to install a control interlock (may be a contactor relay) that will interrupt the power to the control system of the dry cleaning machine when power to the fan is switched off. Thus, a facility operator may operate the ventilation fan during shutdown and maintenance of the dry cleaning machine.

DRY CLEANER VENTILATION GUIDELINES

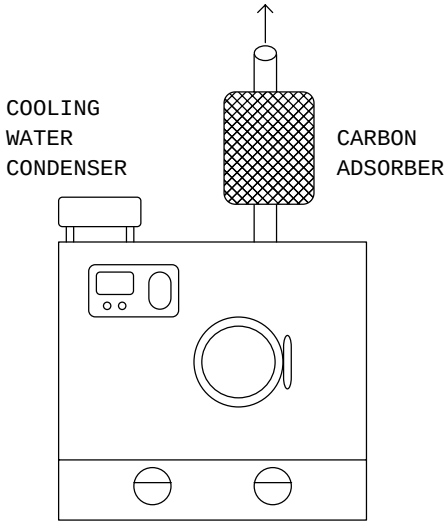
Four Generations of Dry Cleaning Machines

FIRST GENERATION:
TRANSFER SYSTEM



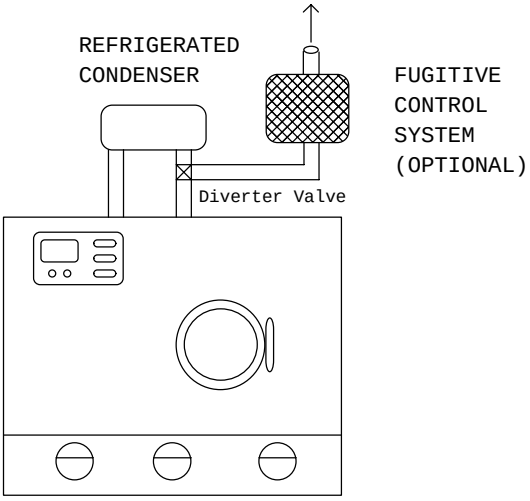
WASHER DRYER

SECOND GENERATION:
VENTED MACHINE



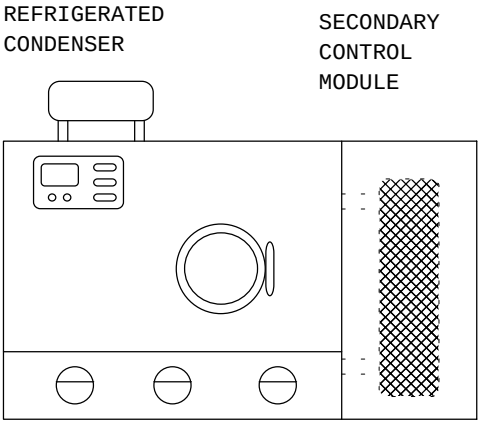
DRY-TO-DRY

THIRD GENERATION:
CLOSED-LOOP MACHINE



DRY-TO-DRY

FOURTH GENERATION:
SECONDARY CONTROL MACHINE



DRY-TO-DRY

Note: A Secondary Control System may vent when door is opened and act as Fugitive Control System.